7.1 Climate and Meteorology

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Meteorological measurements are taken to support Hanford Site emergency preparedness and response, operations, and atmospheric dispersion calculations for dose assessments (Appendix D, Tables D.5 and D.7 through D.9). Support is provided through weather forecasting and maintenance and distribution of climatological data. Forecasting is provided to help manage weather-dependent operations. Climatological data are provided to help plan weather-dependent activities and are used as a resource to assess the environmental effects of site operations.

Local data to support the Hanford Meteorology Station operations are provided via the Hanford Meteorological Monitoring Network. This network consists of 30 remote monitoring stations that transmit data to the Hanford Meteorology Station via radio telemetry every 15 min. There are 27 10-m (30.5-ft) towers and 3 60-m (182.9-ft) towers. Meteorological parameters collected at these stations include wind speed, wind direction, temperature, precipitation, atmospheric pressure, and relative humidity; however, not all parameters are collected at all stations. Figure 7.1.1 shows the wind roses (diagrams showing direction and frequencies of wind) measured at a height of 10 m (30.5 ft) for the network.

The Cascade Range to the west of Yakima, Washington greatly influences the climate of the Hanford Site. These mountains create a rain shadow effect and also serve as a source of cold air drainage, which significantly affects the wind regime.

The Hanford Meteorology Station is located on the 200 Areas plateau, where the prevailing wind direction is from the northwest during all months of the year. The secondary wind direction is from the southwest. Summaries of wind direction indicate that winds from the northwest quadrant occur most often during winter and summer. During spring and fall, the frequency of southwesterly winds increases, with a corresponding decrease in the northwesterly flow. Monthly average wind speeds are lowest during winter months, averaging 10 to 11 km/h (6 to 7 mi/h), and highest during summer, averaging 13 to 15 km/h (8 to 9 mi/h). Wind speeds that are well above average are usually associated with southwesterly winds. However, summertime drainage winds are generally northwesterly and frequently reach 50 km/h (30 mi/h). These winds are most prevalent over the northern portion of the site.

Atmospheric dispersion is a function of wind speed, wind duration and direction, atmospheric stability, and mixing depth. Dispersion conditions are generally good if winds are moderate to strong, the atmosphere is of neutral or unstable stratification, and there is a deep mixing layer. Good dispersion conditions associated with neutral and unstable stratification exist approximately 57% of the time during summer. Less-favorable conditions may occur when wind speed is light and the mixing layer is shallow. These conditions are most common during winter, when moderately to extremely stable stratification exists approximately 66% of the time. Occasionally, there are extended periods of poor dispersion conditions, primarily during winter, which are associated with stagnant air in stationary high-pressure systems.

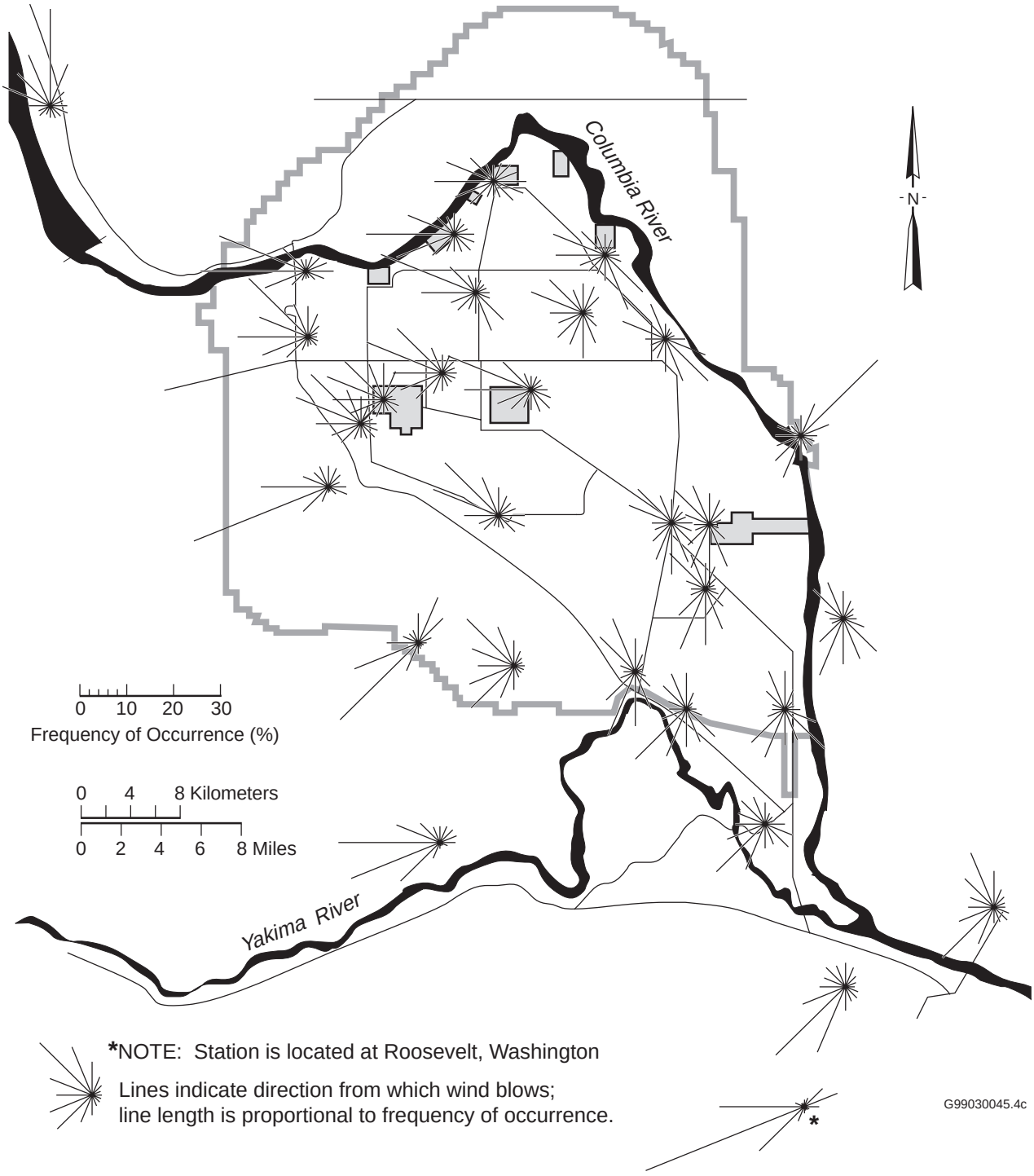

Figure 7.1.1. Hanford Meteorological Monitoring Network Wind Roses (measured at a height of 10 m [30.5 ft]), 1998. Individual lines indicate direction from which wind blows. Length of line is proportional to frequency of occurrences from a particular direction.

7.1.1 Historical Information

Daily and monthly averages and extremes of temperature, dew point temperature, and relative humidity for 1945 through 1998 are reported in PNNL-12087. From 1945 through 1998, the record maximum temperature was 45˚C (113˚F) recorded in August 1961, and the record minimum temperature was -30.6˚C (-23˚F) in February 1950. Normal monthly average temperatures ranged from a low of -0.4˚C (31.3˚F) in January to a high of 24.6˚C (76.2˚F) in July. During winter, the highest monthly average temperature at the Hanford Meteorology Station was 6.9˚C (44.5˚F) in February 1991, and the record lowest was -11.1˚C (12.1˚F) in January 1950. During summer, the record maximum monthly average temperature was 27.9˚C (82.2˚F) in July 1985, and the record minimum was 17.2˚C (63.0˚F) in June 1953. The average annual relative humidity at the Hanford Meteorology Station is 54%. Humidity is highest during winter, averaging approximately 76%, and lowest during summer, averaging approximately 36%. Average annual precipitation at the Hanford Meteorology Station is 15.9 cm (6.26 in.). The wettest year on record, 1995, received 31 cm (12.3 in.) of precipitation; the driest, 1976, received 8 cm (2.99 in.). Most precipitation occurs during late autumn and winter, with more than half of the annual amount occurring from November through February. The snowiest winter on record, 1992-1993, received 142.5 cm (56.1 in.) of snow.

7.1.2 Results of 1998 Monitoring

1998 was warmer than normal, with nearly normal precipitation. The average temperature for 1998 was 13.6˚C (56.4˚F), which was 1.7˚C (3.1˚F) above normal (11.8˚C [53.3˚F]), and tied 1992 as the warmest year on record. Eleven months during 1998 were warmer than normal, and one month was cooler than normal. July had the highest positive departure, 3.2˚C (5.8˚F); October, at 0.3˚C (0.5˚F) below normal, had the only negative departure. The maximum temperature of 44.4˚C (112˚F) on July 27, 1998 was the hottest temperature ever recorded during the month of July. For the year, there were 73 d with maximum temperature ≥32.2˚C (90˚F), the third highest day-total on record. The summer (June, July, and August) and autumn (September, October, and November) of 1998 were the fourth warmest on record.

Precipitation for 1998 totaled 16.4 cm (6.45 in.), 103% of normal (15.9 cm [6.26 in.]), with 18.3 cm (7.2 in.) of snow (compared to an annual normal snowfall of 35.1 cm [13.8 in.]). There were eight thunderstorms recorded at the Hanford Meteorological Station in July 1998, tying 1983 for the most thunderstorms in July.

The average wind speed for 1998 was 12.7 km/h (7.9 mi/h), which was 0.3 km/h (0.2 mi/h) above normal. The peak gust for the year was 90 km/h (56 mi/h) on November 21. November 1998 had a record number of days (10) with wind gusts ≥64 km/h (40 mi/h). Figure 7.1.1 shows the 1998 wind roses (diagrams showing direction and frequencies of wind) measured at a height of 10 m (30.5 ft) for the 30 meteorological monitoring stations on and around the Hanford Site.

Table 7.1.1 provides monthly climatological data from the Hanford Meteorology Station for 1998.

Table 7.1.1. Monthly Climatological Data from the Hanford Meteorology Station, 1998

Hanford Meteorology Station, 40 km (25 mi) northwest of Richland, Washington, latitude 46° 34'N, longitude 119° 35'W, elevation 223 m (733 ft)

Month	Temperatures, °C								Precipitation (cm)				Relative Humidity (%)		15-m Wind[a]				
	Averages				Extremes						Snowfall						Peak Gusts		
	Daily Maximum	Daily Maximum	Monthly	Departure[b]	Highest	Date	Lowest	Date	Total	Departure[b]	Total	Departure[b]	Average	Departure[b]	Average Speed, km/h	Departure[b]	Speed, km/h	Direction	Date
J	6.7	-2.1	2.3	+2.7	13.9	19[c]	-13.9	13	3.1	+1.1	16.0	+6.1	76.3	-0.1	12.6	+2.1	69	SW	24
F	10.9	0.4	5.7	+2.3	14.4	21	-5.6	27	2.9	+1.3	T[d]	-5.1	74.4	+4.1	11.7	+0.2	80	S	21
M	15.7	2.5	9.1	+1.6	22.2	13	-5.0	5	1.3	+0.1	T	-0.8	58.4	+2.5	11.7	-1.6	63	WSW	26
A	20.4	4.5	12.4	+0.9	33.3	30	-1.7	12	0.2	-0.9	0	T	49.4	+2.2	12.2	-2.3	60	W	24
M	24.6	9.2	16.9	+0.6	33.9	6[c]	3.9	15	1.3	0.0	0	0	53.2	+10.5	12.9	-1.8	88	WNW	21
J	29.8	13.6	21.7	+0.7	37.2	30	8.3	27	1.2	+0.3	0	0	41.0	+2.2	15.8	+1.0	80	WNW	15
J	36.3	19.3	27.8	+3.2	44.4	27	14.4	20[c]	0.9	+0.4	0	0	33.6	+0.1	13.0	-1.1	76	WSW	27
A	34.7	16.3	25.5	+1.6	43.3	4	10.0	24	0.1	-0.6	0	0	33.0	-2.8	13.0	+0.3	80	NW	15
S	30.6	12.8	21.7	+2.9	39.4	1	6.1	27	0.3	-0.5	0	0	42.6	-0.1	10.8	-1.1	56	WSW	17
O	18.7	3.9	11.3	-0.3	28.9	1	-3.9	30	0.7	-0.3	0	-0.2	56.7	+1.5	11.3	+0.8	74	SW	8
N	12.1	3.0	7.6	+3.0	19.4	25[c]	-2.8	19[c]	3.3	+1.0	0	-4.6	72.8	-0.6	14.2	+3.9	90	SSW	21
D	5.4	-4.3	0.6	+0.9	15.6	29	-18.3	21	1.1	-1.5	2.3	-12.2	72.3	-8.0	12.6	+3.1	88	WSW	26
Y[e]	20.5	6.6	13.6	+1.7	44.4	Jul 27	-18.3	Dec 21	16.4	+0.5	18.3	-16.8	55.3	+1.0	12.7	+0.3	90	SSW	Nov 21

NOTE: See Table H.2, Conversion Table in "Helpful Information" for unit conversion information.
(a) Measured on a tower 15 m (50 ft) above the ground.
(b) Departure columns indicate positive or negative departure of meteorological parameters from 30-yr (1961-1990) climatological normals.
(c) Latest of several occurrences.
(d) Trace.
(e) Yearly averages, extremes, and totals.